Translation from Bulgarian

REPUBLIC OF BULGARIA
MINISTRY OF ENVIRONMENT AND WATER

DECISION
ON ENVIRONMENTAL IMPACT ASSESSMENT

No. 7-7/2016

Pursuant to Art. 99, para 2 of the *Environmental Protection Act*, Art. 19, para 1 of the *Ordinance on the terms and procedure for performing environmental impact assessment* (EIA Ordinance), § 3, para 1 of Transitional and Final Provisions to *Decree No. 26 of the Council of Ministers of 9 February 2016 Amending and Supplementing Regulations of the Council of Ministers* (SG, No. 12/2016) and in connection with Art. 31 of the *Biological Diversity Act* (BDA) and in connection with Art. 38 of the *Ordinance laying down the terms and procedure for assessing the compatibility of plans, programmes, projects and investment proposals with the subject and objectives of protected areas conservation* (Ordinance on CA),

I APPROVE

The implementation of an investment proposal for **"Construction of national disposal facility for low and intermediate level radioactive waste – NDF"** – based on technology for disposal of low and intermediate level radioactive waste (RAW) at multi-barrier engineered trench-type surface repository

Contracting Authority: State Enterprise Radioactive Waste

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Summary of the investment proposal:

The investment proposal (IP) is for the construction of a national disposal facility for low and intermediate level radioactive waste (NDF) at Radiana site. Construction of the facility is in fulfilment of the obligation of the Republic of Bulgaria under the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management* and *Directive 2011/70/Euratom of 19 July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste,* in compliance with the requirements of the national legislation and the safety standards of the International Atomic Energy Agency (IAEA). NDF is intended for disposal of low and intermediate level radioactive waste of category 2a conditioned and packed in reinforced concrete containers, which is generated as a result of the operation of Kozloduy NPP, new nuclear capacities, decommissioning of Kozloduy NPP as well as of radioactive waste (RAW) of category 2a generated in the use of radioactive sources of ionizing radiation in industry, medicine, agriculture and research.

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Radiana site is located in close proximity to Kozloduy NPP and falls within the 2 km zone for preventive protective measures (ZPPM) of Kozloduy NPP. It is positioned 3.3 km south-east of the regulatory line of Kozloduy, 4.3 km north-east of the construction boundaries of the village of Harlets and about 4.2 km south-west of the right bank of the Danube river.

For selecting Radiana site as a national repository site, the territory of the country has been analysed by taking into account the natural resources, including geology, geotechnical, hydrological, hydrogeological, geomorphological and climatic conditions. Potential areas and sites have been distinguished and prospective sites have been determined. They have been subject to extensive field and laboratory research. The site for the construction of NDF has been determined on the basis of a comparative analysis. The following groups of criteria have been evaluated in the comparative analysis: safety provided by natural conditions (group A); impacts of adverse processes and phenomena (group B); possible impacts on the environment and population (group C); socio-economic acceptability (group D);

Transport Infrastructure

The site is accessible from the north via the internal plant road of Kozloduy NPP Second-class national road II-11 Kozloduy-Harlets-Mizia is on the south side. The transportation of radioactive waste will be performed from a conditioned RAW storage facility (at the Kozloduy NPP site) via the internal plant road of Kozloduy NPP.

Water Supply System

Water supply will be performed through a branch of a drinking water main brought off site.

Sewage System

A separate sewage network is planned to be constructed at the site, for domestic-fecal wastewater from the administrative area, for rain water and from an internal drainage system from the repository cells which allows for capturing and collecting the water that has possibly permeated (infiltrated) to the containers with conditioned RAW.

The internal drainage system will be constructed in a manner that will allow establishing the exact location of a cell with disposed radioactive waste in which moisture has penetrated, and the condition of the containers. In accordance with the requirements of nuclear law, water from the internal drainage system of the disposal modules is subjected to radiation control.

Discharge of domestic-fecal water will be performed at the domestic-fecal sewage system of Kozloduy NPP.

Surface (drainage) water is planned to be directed to the drainage sewer system of Kozloduy NPP and then to a main drain of the Blatoto drain system managed by Irrigation Systems. Surface water for discharge will come form a rainwater collection basin which will be situated in close proximity to the road leading to Kozloduy NPP, on the most inferior part of the site. Only rainwater from the site measured and defined in advance as clear water from reservoirs for infiltration control and clean water from the deep drainage network, will be directed to the basin.

Power Supply

NDF will be supplied with power through a branch of the overhead power line ELBA, 20 kV from power substation Kozloduy and a purpose-built power substation.

Main stages of implementation

Construction:

The construction of NDF is planned to be carried out stage-by-stage, in three stages. The infrastructure of the national repository and the first module of the disposal facility will be constructed during the first stage (by 2021).

Operation:

The operation period of NDF – from starting the loading of the first module to the end of repository operation, continues for 60 years and is combined with the construction works during the second and the third stage of construction of the second and third module, respectively.

Closure:

It consists of deactivation and dismantling or sealing of all construction structures, systems and equipment used for acceptance and placement of RAW; disposal of RAW generated as a result of such works; bringing the facility into a condition ensuring its safety for a long period of time; establishing the systems for monitoring ans surveillance of the facility, the site, the zone for preventive protective measures and the supervised area; updating and archiving the information about the facility. The facility closure will continue for 15 years.

Institutional control:

The period of institutional control has a total duration of 300 years. It includes carrying out monitoring, access control, minimum technical maintenance of the facility and the systems and infrastructure related to it, and, if proven necessary and efficient, carrying out rehabilitation activities and corrective measures.

Description of the main processes during the operation stage of NDF

Radioactive waste disposal in disposal facilities consists of performing simple technological operations of placement in disposal cells, enhanced control over the condition of the radioactive waste, the facilities, the site, the zone for preventive protective measures which is within the fence, and a supervised area.

No radioactive waste treatment and conditioning activities are envisaged at the NDF site. Radioactive waste is delivered to the site treated, conditioned and packed in reinforced concrete containers (RCC) with dimensions of 1.95 x 1.95 x 1.95 m.

Low and intermediate level short-lived radioactive waste (category 2a according to the categorization of the *Ordinance on the Safety of Radioactive Waste Management*) generated on the territory of the Republic of Bulgaria, will be disposed at NDF.

The technological operations of placing the RCC in the disposal facilities include:

- Transportation of RCC with a specialized transport vehicle from the storage facility for conditioned radioactive waste (SFCRAW) of SE RAW located on the site of Kozloduy NPP, via a particular route;
- Acceptance and incoming inspection of the packages with RAW according to specific criteria
- Temporary buffer storage (in a building built for the purpose) of the packages before disposal in order to optimize the technological process of placing RCC in the facility, in accordance with a flowsheet prepared.
- Placing the packages with radioactive waste in the disposal facility;
- Documenting and maintaining a database.

Characteristics of RAW subject to disposal at NDF, expected type and quantity, productivity, capacity

The origin of the waste subject to disposal at NDF is:

- Waste generated during the operation and decommissioning of Kozloduy NPP;

- Waste generated during the operation of possible new nuclear capacity;
- Waste generated during the decommissioning of the IRT-2000 research reactor stopped of operation;
- Waste generated during the use of radioactive sources in industry, agriculture, research and medicine stored at the Specialized Division Permanent Repository for Radioactive Waste – Novi Han.

RAW is processed at a radioactive waste processing workshop of the Specialized Division of SA RAW (SD RAW - Kozloduy), which is located at the NPP site. Radioactive waste is conditioned applying the cementation method and are packed in RCC in compliance with the quality requirements, including providing strength characteristics, watertightness and frost resistance of concrete.

The RCC walls provide biological protection so that the power of the equivalent dose of gamma radiation from RAW does not exceed 2 mSv/h at each point on its external surface and 0.1 mSv/h at 1 m distance from the surface.

The preliminary assessment of the amount of radioactive waste subject to disposal in NDF amounts to 18 615 RCC (138 200 m^3 or 345 500 tons). The repository capacity determined with a certain reserve, amounts to 19 008 packages of RAW (142 000 m^3).

Two alternative technologies for the disposal of low and intermediate level RAW of category 2a are considered for the construction of NDF – technology for disposal of low and intermediate level RAW in trenches, and technology for disposal of low and intermediate level RAW in a tunnel type repository. Both technologies are multi-barrier engineered surface repositories.

Technology for disposal of low and intermediate level RAW in a trench type multi-barrier engineered surface repository

Design of a trench type repository

The repository is located at a depth of 35 m below the surface of the terrain on consolidated Pliocene clays. It consists of 66 cells for disposal of packages with radioactive waste situated on 3 identical platforms, each one of them containing 22 cells. The disposal cells are arranged in two rows. The capacity of each disposal platform is 6336 reinforced concrete containers (RCC), and the capacity of each cell is 288 RCC.

The disposal cells are monolithic, concrete (concrete class C35/45 according to BDS EN 1992-1-118 and BDS EN 206-119 and reinforcing steel grade B500B according to BDS EN 1008020), with dimensions in plan 20.15 m /17.05 m and height of 9.45 m. They are designed with no structural joint between them. Each cell is divided into three chambers containing 96 RCCs arranged in 4 rows in vertical order.

The cells are constructed on a loess-cement cushion which is 5 m thick. The foundation is a base plate 0.60 m thick. The internal and external walls are 0.50 m thick, and the covering slab is 0.60 m thick.

Before being filled with containers, the empty cells are protected from weather conditions by mounting waterproof cover panels 0.25 m thick. Thus protected, the cells remain unchanged throughout the entire period from their construction to the start of their filling, i.e. the entire period during which they may remain empty. After arranging the four rows of containers, the cell is covered with similar cover panels. The monolithic reinforced concrete cover slab 0,60 m thick and waterproof, is constructed.

During the process of filling, the cells are protected with a sliding roof. After sealing the cell, the roof is moved to the next cell along a track. The two rows of cells are equipped with a bridge crane with a design load of 40 t. Cranes are also used in positioning the RCC in the disposal cells and in closing of the cells.

The cells are designed for the entire life cycle of the national repository – 375 years.

Repository capacity

Each of the cells has a capacity for 288 packages (RCC) of radioactive waste. The total capacity of the repository is 19 008 RCC.

Required area. Auxiliary buildings and facilities

The total area required for the construction of a trench type repository is 46.4 hectares. In the process of repository construction, additional area of 0.40 hectares will be required for temporary storage of 90 000 m^3 of loess which will be used for the execution of the loess-cement cushion, and of 68 000 m^3 of humus which will be used for backfilling and cultivation of the site.

Radiana site is divided into a "controlled area" and a "supervised area". The disposal facilities and the building for acceptance and temporary operating storage of the packages with radioactive waste are situated in the controlled area. The supervised area includes a building for access control (a checkpoint), an administrative building providing appropriate working conditions for the staff with offices, a conference room, space for archives and auxiliary equipment, laboratories, a building for service systems with workshops with various applications and an industrial section which contains the energy supply systems and other systems, a building for physical protection and a command room intended for 24-hour control and supervision of the site, a main service building located at the boundary between the controlled and the supervised areas which provides radioactive protection, control of the access to the controlled area, radiation control of people and materials. A fencing system will be constructed – warning, slowing down and stopping fences equipped with technical means of control and video surveillance.

Passive systems for ensuring safety

The passive safety systems are the elements of the multi-barrier system, as follows:

- **The first engineered barrier** is the waste form which is cemented radioactive waste (cement matrix). The safety of the waste form is related to the incorporation of the radionuclides in the solid phase of the matrix and their retention through adsorption and settling in the highly alkaline cement. The cement matrix is a chemical barrier which retains its safety functions for thousands of years.
- **The second engineered barrier** is the reinforced concrete container (RCC) which contains the cemented radioactive waste. The free space between the cement matrix and the lid of the reinforced concrete container is filled with grout. RCC should allow for the retrieval of the waste in the period until the final closure of NDF. The safety function is to ensure full retention through maintaining the mechanical integrity, including the integrity of the container holds during the operation of the repository. RCC maintains its function as a chemical barrier for thousand of years.
- **The third engineered barrier** includes the reinforced concrete disposal cells, the foundations, the closing plates, and the filling material. Its safety function consists of retention of potentially released radionuclides from packages with RAW by maintaining the integrity of the cells for the period of operation of the repository, which continues for 60 years, for the period of closing the repository, which continues for 15 years, and throughout the entire period of

institutional control, which continues for 300 years. The design life of the repository structures is 375 years.

- **The fourth engineered barrier** includes the loess-cement base and the multi-layer cover. Besides being a barrier against migration of radionuclides, the foundation also increases the height of the unsaturated zone and improves the overall condition of the foundation. Multi-layer protective cover is planned to be built from natural materials (clay, sand, gravel, etc.) with a structure which: minimizes the infiltration flow from rainwater through the repository system by ensuring an infiltrating hydraulic flow below 1.5 L/m^2 per year through the repository modules; acts as a barrier against external damage of the barrier system from people, animals, or plants; provides protection against continuous erosive agents, such as rain and wind.
- **The fifth (natural) barrier** is performed by the favourable characteristics of the site.

Safety is ensured entirely by passive means. The structure of the trench type repository is such that no active safety systems are required.

Process of placing RCC in a trench type repository

Before placement of RCC in a disposal cell starts, a detailed control of the cell is performed, incl. waterproof control. The sliding roof is positioned above the cell by covering also the unloading area located on the outside of the rows of cells. The drainage of each cell is connected to the infiltrated water control network.

The radioactive waste is transported with an internal-plant specialized transport vehicle to the cell area which is to be filled, via a specified route, from the buffer storage building.

In the buffer storage building, RCC is loaded on a transport platform by means of a remote-controlled bridge crane. After RCC is transported to the unloading area of the cell, the operation for placing RCC is carried out remotely using the remote-controlled bridge crane on the sliding roof managed from the main command room by means of a video surveillance system.

Infiltrate management system

The infiltrate control system is designed in such a way as to capture and collect the infiltrate separately from every external chamber of the disposal cells. It consists of a pipeline system located in an underground gallery accessible to people which runs under each row of cells.

The galleries are 1.20 wide and 2.20 high made of reinforced concrete walls, bottom and a cover slab 0.30 m thick, with cement-polymer waterproofing composition. A pipeline system (PVC pipes) and control containers with sampling devices are positioned in the galleries.

Infiltrated water is controlled for radioactive contamination. If radioactive contamination is established, the water is transported to SD RAW - Kozloduy for treatment. Clean water is directed to a rain water collection basin. The infiltrate control system provides control of the separate cells in the repository and of the sectors within the cells. The design life time of the gallery is 375 years. Placing the pipeline system in a drainage gallery allows for carrying out control and the appropriate maintenance for the entire life cycle of the repository – the period of operation and the period of institutional control.

Methods of control and monitoring during the period of operation of NDF

During the operation of the repository, the following monitoring activities will be carried out: *radiation monitoring* of the site and the supervised area, *hydrogeological monitoring*, *seismic monitoring* and *meteorological monitoring* of the site.

The design of a trench type repository allows for direct control and monitoring of the condition of the waste and the condition of structures. During the period of operation, the following control activities will be carried out: *geodesic control* over the horizontal and vertical deformations through precise geodetic surveying of the ground and the structures; *radiation control* of the power of the equivalent dose of gamma radiation of the repository cells; *control over the condition of packages and the repository engineered barriers.*

Retrieval of RCC after the period of operation

In accordance with the legal requirements, the design of the repository allows for the retrieval of packages with radioactive waste during the period of operation – retrieval of the entire amount of waste in the facility and retrieval of possible defective package/packages. The removal of packages is performed using handling and transport equipment which is also used for placement of RCC in the repository cells.

Construction of a trench type repository

The construction of a trench type repository will be performed using standard construction equipment in strict compliance with the requirements for quality of materials and quality of performance.

The construction will be carried out stage-by-stage. The first platform with 22 cells for disposal of radioactive waste, the infrastructure of the site and the service buildings and facilities will be constructed at the first stage. Construction of the second and third stage (second and third platform, each with 22 disposal cells, respectively) will be carried out by physical separation of the construction activities from the operation activities through a fence/fences and by using a separate road for access of machines, materials and construction workers.

Organization of the construction includes the following main activities:

- Site preparation: cleaning, removal of the topsoil layer; building construction roads, preparatory work for building a depot for earth masses which will be used upon closure of the repository; preparatory works for constructing the drainage basin for surface water;
- Making the trench: The collapsible loess from the upper layers will be stored at a temporary depot near Radiana site and will be used for constructing the loess-cement cushion. The loess to be used for closing the repository is placed at the depot for earth masses prepared. The loess from the lower layers of the trench (the last 6 m) which is clayed and is not suitable for use upon closure of the repository, is transported off-site as excess earth masses;
- Execution of the loess-cement cushion with thickness of 5.00 m: It is executed in layers with thickness up to 25 cm. The drainage galleries under each row of disposal cells are built and the foundations of the sliding roofs are laid in the loess-cement cushion.
- Construction of the reinforced concrete cells: The bottom plate, the cell walls and the internal walls are constructed. The finished cells are covered with reinforced concrete cover panels which are placed on top of the cell walls using a crane, protecting the cells until they are put into operation. Waterproofing is carried out. An additional finishing layer of the loess-cement cushion is built to a height above the bottom plate of the cells.
- Setting up sliding roofs and bridge cranes;
- Construction of drainage systems under the slope and around the cells (for surface water);
- Construction of auxiliary buildings and facilities, including the building for buffer storage of radioactive waste before disposal – it is carried out alongside with the construction of the repository cells.

- Covering with soil and planting.

Management of earth masses and humus

The humus removed from the site (about 68 000 m^3) which is subject to reuse and cultivation of the environment during the construction of the facility, will be stored at a temporary site during construction located at a distance of about 1 km from Radiana site. The humus removed during the construction of the second and the third stage of the repository (about 19 000 m^3 and 24 000 m^3, respectively), will be reused for cultivation of the environment and improvement of low-productive land.

A significant part of the earth masses excavated during the first stage of the repository construction will be stored at a depot situated at Radiana site, since it will be used for backfilling and construction of the protective multi-barrier cover upon closing the repository. The excess earth masses that are not suitable for use during the closure (about 220 000 m^3) will be placed near the site.

A depot for earth masses will be constructed on an area of 70 000 m^2 on-site.

Stages of construction of trench type NDF

Stage 1 includes construction of the first platform with 22 cells for disposal of radioactive waste, the auxiliary buildings and facilities, and the site infrastructure; the capacity of stage 1 is 6336 RCCs;

Stage 2 includes operation of the constructed first platform and construction of the second platform with 22 cells for disposal of radioactive waste; the total capacity of the repository at stage 2 is 12672 RCCs;

Stage 3 includes construction of the last platform with 22 disposal cells in parallel with the operation of the second platform; the total capacity of the repository is 19008 RCCs.

Closure of a trench type repository

The closure of the repository for radioactive waste disposal is performed in accordance with a technical project for closure, a plan for closure, postoperative period safety assessment and safety assessment upon closure, which are approved by the Nuclear Regulatory Agency.

Closure of repository cells consists of filling the minimum remaining free space with gravel, installation of cover panels, construction of a cover slab and its waterproofing, as follows:

- The gaps between the packages with RAW are filled with gravel or other suitable material. It is delivered through a hose by a special device suited for the bridge crane;
- The concrete panels prepared in advance are placed (using the bridge crane) on the top of the cell wall by a remote control from the main command room.
- A layer of polyethylene which prevents the binding of the new concrete of the cover slab and the penetration of concrete in the joints of panels is placed on top of the concrete panels.
- A levelling layer of concrete is poured;
- A closing concrete slab 0.6 m thick is built.
- The cover slab is covered with a waterproof cover.

Operations are performed under the sliding roof which provides protection for the placed packages and the closure works from weather conditions. The closure of a cell takes place within 4-5 months.

After the end of the operation period, the final closure of the repository starts by constructing a protective multi-barrier cover to ensure an infiltrating hydraulic flow that is significantly lower than that of the natural environment, thus minimizing the access of moisture

to the repository system. The protective multi-barrier cover consists of persistent barriers based on a low-permeability material (such as compacted clay) designed to reduce the flow of water in the disposal cells, as well as conductive barriers applying the phenomenon of capillary barrier to direct the water away from the waste.

The protective multi-barrier cover consists of the following layers:

- An upper humus layer with plants with shallow root system (grass). The layer is 10 cm thick, its hydraulic conductivity is 10^{-2} m/s;
- An anti-erosion layer of clay with gravel 40 cm thick, with hydraulic conductivity of 10^{-2} m/s, which is made in layers;
- A base of compacted loess 50 cm thick, with hydraulic conductivity of 10^{-7} m/s, which is made in layers;
- A protective layer of gravel and stones 40 cm thick, with hydraulic conductivity of 10^{-1} m/s, the function of which, in addition to protecting from mechanical damage, will be directing the permeated water to the drainage system;
- Geotextile 1 cm thick, with hydraulic conductivity of $10^{-4} \div 10^{-3}$ m/s, the function of which will be to physically separate the two layers – the upper and the lower drainage layers;
- A main drainage layer to drain the moisture that has reached it and direct it to the drainage system, consisting of a 10 cm sand layer with hydraulic conductivity of 10^{-3} m/s, a 10 cm layer of coarse sand of gravel with hydraulic conductivity of 10^{-2} m/s and a 10 cm gravel layer with hydraulic conductivity of 10^{-1} m/s;
- Watertight layer of sheets of high density polyethylene or bentonite geocomposites 0,2 cm thick, with hydraulic conductivity of 10^{-11} m/s, which is to separate the upper primary drainage filtration layer from the lower layer of compacted clay;
- A main waterproofing of waterproof clay 100 cm thick, with hydraulic conductivity of 10^{-9} m/s;
- Support base of low plastic materials 30 cm thick, with hydraulic conductivity of 10^{-5} m/s (sand-clay and gravel);
- Reinforced concrete cell with hydraulic conductivity of 10^{-8} m/s.

Drainage layers will direct the infiltrated water to drainage ditches located on the northern border of the site. The infiltrated water is subject to monitoring and control. The multi-layer protective cover provides infiltrating hydraulic flow below 1.5 L/m^2 per year through the repository modules.

Together with performing the activities for constructing the multi-barrier protective cover and backfilling, an inspection of the infiltrate control system designed for a period of operation of 375 years will be conducted.

Methods of control and monitoring during the period of institutional control

During the period of institutional control, a radiation monitoring programme and an environmental monitoring programme will be implemented. The monitored parameters will be chosen in such a way as to ensure effective monitoring.

The project provides for full control over the condition of the buried radioactive waste and the condition of the repository structure through the infiltration control system which is designed to operate for 375 years. No repair works of the system galleries are planned except for basic maintenance of the waterproofing coating. The pipeline system for drainage of possibly permeated water described above is made of standard elements allowing easy maintenance and replacement, if necessary.

The condition of the protective multi-barrier cover will be controlled not only visually but also through the methods of geodetic control and drainage control which are part of it.

Technology for disposal of low and intermediate level RAW in a tunnel type multi-barrier engineered surface repository

Structure of a tunnel type repository

The repository consists of 8 parallel tunnel constructions (galleries) where the containers with radioactive waste (RCC) are placed; each construction is 1130 m long and has a diameter of 6.5 m. The tunnel constructions for placing the RCCs are positioned along the length of Radiana site, parallel to the access road. Servicing of the tunnel constructions for the RCCs is carried out through 3 perpendicular service galleries – a transport shaft, a service gallery and a ventilation shaft, with a diameter of 3.7 m. An experimental shaft is further built, so the total length of the mine constructions is 9770 m.

The tunnel constructions are placed in a single plane at a depth of 25-30 m under the surface of the terrain, in the loess clays of the site.

The axial distance between the galleries for placement of radioactive waste is 20 m. The access is realized through a transport shaft starting at level 59. Ventilation is provided through a perpendicular ventilation shaft.

The tunnels for radioactive waste are equipped with a waterproof multi-layer reinforced concrete lining with a total thickness of 0.45 m. The construction is further consolidated through micropiles and injection silicatization or cementation. A 40 cm concrete slab with drainage ditches which are part of the water catchment system, is built in the lower part of the tunnel constructions. Pipes for directing potentially polluted water run under the concrete slab. Drainage water from the ditches and the possibly polluted water from the pipelines are managed separately and are discharged into separate receivers positioned above ground at the site and equipped with sampling devices. Before starting the placement of radioactive waste, water is considered to be clean mine water and is discharged into a clean water receiver. After placing the containers with radioactive waste, water is considered to be potentially contaminated and is discharged into a contaminated water receiver.

Repository capacity

The capacity of each tunnel construction is 2150 RCCs. Two sectors with radioactive waste are formed in each gallery, each with capacity of 1075 RCCs, separated by the service shaft. The containers are arranged lengthwise in the galleries, in two rows, two in vertical order. The total capacity of the repository is 17 200 RCCs.

Auxiliary buildings and facilities

Auxiliary buildings and facilities are constructed on the surface. They are situated in two sites with different functions – West site and East site. The West site includes the technological equipment for radioactive waste management, service buildings and facilities which are generally the same for both technologies for disposal of radioactive waste; the charging station for the remote-controlled transportation and lifting equipment and for the electric lamps used by the operational personnel and the construction workers, is specific for the technology of placing radioactive waste in tunnels. The East site includes the construction of the mining and construction complex, the mining ventilation system and the water reception system (charging station for the accumulator locomotives, a workshop for construction equipment maintenance,

compressor and ventilation system, site for loading the excavated earth masses, service portal crane).

Required area at Radiana site

The required area, including the roads used for transportation of radioactive waste to the disposal facilities, is 47.5 hectares.

In accordance with the requirements of nuclear law, the entire Radiana site is considered a nuclear facility site where surface and shallow underground facilities are located. The requirements for physical protection and the rules and standards for ensuring fire safety of nuclear facilities apply to the site. A fencing system (warning, slowing down and stopping fences) equipped with technical means of control and video surveillance is planned to be constructed.

Suitable grass plants will be planted at the site. A surface water drainage system will be constructed – channels with rectangular cross-sections of precast concrete elements leading the rain water to an open water collection basin. No use of additional area for the construction of the repository is envisaged.

Passive systems for ensuring safety

The passive safety systems are the elements of the multi-barrier system, as follows:

- **The first engineered barrierr** is the waste form (the cement matrix) which is a chemical barrier with safety functions for thousands of years.
- **The second engineered barrier** is the reinforced concrete container (RCC) which contains the cemented radioactive waste. The safety function is to ensure full retention through maintaining its mechanical integrity during the period of operation of the repository. RCC maintains its function as a chemical barrier for thousand of years.
- **The third engineered barrier** is the tunnel construction made of 40 cm waterproof concrete, the filling material around the containers and the consolidated zone around the placement gallery which is 40 cm thick. The safety function is to maintain the mechanical integrity of the system for a minimum of 150 years.
- **The fourth (natural) barrier** is performed by the favourable characteristics of the site.

Active systems for ensuring safety

The tunnel type repository is equipped with a П-shaped (backflow) common mine ventilation. The clear ventilation flow enters the transport shaft, passes through the placement galleries and is sucked toward the ventilation shaft by the main ventilating fan which operates in a suction mode.

Description of the process of placing RCC in the tunnel constructions

The specific activities determined by the disposal technology are as follows:

Radioactive waste is delivered to the underground complex (a tunnel repository for radioactive waste disposal) through the transport shaft and is moved to the place of positioning in the tunnel construction. Transportation and placement are carried out using a remote-controlled transport and unloading machine (heavy duty forklift truck) along a track. The transport and unloading machine moves along a track dug into the concrete foundations of the transport shaft and the galleries for radioactive waste. The forklift truck has a load capacity of 25 tons and a lift height of 3 m. Monitoring of the process of transportation and placement is carried out using video surveillance cameras.

Infiltrate management system

Potentially contaminated water is captured by the longitudinal channels (furrows) where the tracks of the transport and lifting equipment are mounted, and every 50 m it is discharged in a pipeline system built under the foundation on which the containers with radioactive waste are placed. The pipeline system is lead through the ventilation shaft to a collection reservoir. A building with a water tank is planned to be constructed at the East site.

The pipeline system should be constructed in such a way as to allow the control of determining from which repository sector contaminated water can be delivered, which suggests designing (at a subsequent stage) technical means of control at the outlet of each pipeline. In case of radioactive contamination the water is transported to SD RAW - Kozloduy for treatment. Clean water is directed to the rain water collection basin.

Thus designed, the pipeline system does no allow exercising control over its condition and establishing defects during the 60-year period of operation, respectively. The pipeline system is made from standard materials and it is supposed that its operability will be maintained for the 60-year period of operation, which is provided only by means of the quality assurance system in the process of construction.

The pipeline system is disassembled during the repository closure stage, after which drainage of potentially contaminated water from the tunnel constructions with radioactive waste is carried out by gravity to a ventilation (drainage) shaft (which is filled with inert material) and is directed to a basin located at the bottom of the ventilation shaft. From the basin, water penetrates the containment structure passing trough porous concrete.

Methods of control and monitoring during the period of operation of NDF

During the operation of the repository, as well as the trench type repository, the following activities will be carried out: *radiation monitoring* of the site and the supervised area, *hydrogeological monitoring, seismic monitoring* and *meteorological monitoring* of the site.

Direct control over the condition of the tunnel constructions for radioactive waste disposal can be performed only until the time of placing the RCCs. After their placement, no control over the condition of the packages and the condition of the tunnel constructions will be possible. For this reason, the control over the condition of the tunnels with RCCs is planned to be performed through examination of micro-deformations and the tense deformed state in the structure by non-destructive methods in the experimental shaft.

The control over the condition of water is exercised only in the process of filling a given tunnel construction in view of the proposed concept of closure. After a given tunnel construction is closed under operating conditions, control can be exercised over the entire quantity of water, but the condition of packages and engineered barriers in the individual tunnel sections cannot be directly controlled. The control over the condition of the packages with radioactive waste is carried out through control over a limited quantity of RCCs placed in the experimental shaft.

Retrieval of RCC after the period of operation

- possibility for retrieving the entire amount of waste in the facility:

Retrieval of the entire amount is very difficult in the closed tunnel constructions given the large amount of filling material, which, besides technical difficulties, calls for extended stay of the personnel involved in the retrieval operations;

- possibility for retrieving a possible defective package/packages.

Retrieval of a possible defective package/packages is related to the retrieval of a considerable amount of packages until finding the defective one.

Need for test facilities before the construction of a tunnel type repository

The construction of an experimental shaft is planned to take place before the construction of a tunnel type repository in view of an in situ study of the interaction of the host boy galleries and of defining the voltage to arise in the boy. It is planned to test various tunnelling methods and tunnel strengthening for which an experimental shaft will be used.

Construction of a tunnel type repository

The construction is to be performed following standard mining methods, using mining combine and a monorail lining placing machine, a complex for the preparation, filling-in and laying of fast-hardening hydro-mixtures, a combine loader, a drilling machine for injections and a rubber-belt loader. The excavated earth masses shall be taken out by small carriages driven by mine fireless locomotives to "Iztok" construction site along rails used only for the purposes of construction that shall be dismantled afterwards. In the beginning of mining construction air conditioning shall be provided by mine ventilators for local ventilation placed on the surface.

The construction of tunnels for radioactive waste disposal is a two-phase process that involves:

- the production of a so called pilot construction with a small diameter (4.00 m);
- laying a temporary lining;
- waiting 4 to 6 months for voltages to balance;
- expansion of the necessary diameter (7.40 m) and laying the final multi-layer lining.

The underground constructions concrete shall be prepared on the surface following a specific technology The boy is planned to be enhanced by anchoring with micro piles and follow-up silicatization (injection of water glass and other additives) or cementation (injection of cement solution).

Management of earth masses and humus

During the construction of a tunnel type repository, together with the ancillary facilities, and the site infrastructure, about 70,200 m^3 of humus are produced, 43,860 m^3 of which will be reused to reclaim the site upon closure the repository. It is planned that a landfill for the humus material required for reclaiming, to be used upon closure the repository after the 60-year period of operation, be built at the site.

Surplus humus masses in the amount of 26,340 m^3, may be used for various improvement exercises in nearby localities.

The volume of surplus earth masses subject to be disposed of (placement in a dump outside of Radiana site) amounts to 650,000 m^3 of earth mass. This amount is twice as large as the available possibilities for securing locations for placing earth masses near the site, which implies dumping in places at a larger distance.

Stages of construction of tunnel type NDF

Stage 1 involves the construction of the first tunnel constructions and the site infrastructure. The capacity of stage 1 is 4300 RCCs.

Stage 2 includes the operation of the 2 finished tunnel constructions and building three galleries for the disposal of RAW. The total capacity of stage 2 is 10750 RCCs.

Stage 3 includes construction of the last three galleries (tunnels) for the placement of RAW in parallel with the use of the existing ones. The total capacity of the repository is 17200 RCC.

Need for test facilities before the closure of a tunnel type repository

During the operation of the repository, various materials to fill the free space in the tunnel constructions with disposed radioactive waste will be tested. The testing will be performed in the experimental shaft.

Closure of the repository (specific characteristics of the closure of a tunnel type repository)

Closure of the repository will be done in stages, by consecutive filling with fill-in material and sealing of gallery entrances as early as at the operation stage by using a standard pneumo- and hydro-transport mechanisation.

Closure shall be done as follows:

- Disassembly of the drainage pipes in the tunnel constructions. The system does not allow disassembly of the rails located below the radioactive waste containers;
- The tunnel constructions where radioactive waste is disposed of, are filled with fill-in material;
- The entrances of the tunnel constructions where the radioactive waste are disposed of are sealed with clay „plug" and concrete walls (a 30 m construction limited on the two sides with reinforced concrete barriers that are 35 cm thick. Inside, there are 2 reinforced concrete barriers with thickness of 35 cm that are located at a distance of 10 m each. The space between the barriers is filled in with clay pulp by pumping);
- After all tunnel constructions are filled with fill-in material, the facilities in the ventilation and transport shaft, including the railway and the rest of the equipment are dismantled. The shafts are filled with inert material. Clay plugs are built at the entrance of each shaft;
- Any waters that have happened to enter the repository or have been generated by the fill-in material and the packages, are directed to the ventilation gallery where there is a concrete reservoir (basin) with sufficient capacity, filled in with sorbing material (porous concrete).

There are two options proposed for fill-in material – filling-in with a loess-cement hydro-mixture prepared in a filling-in complex composed of a mixer with dosimeters, and filling-in with a granulated loose material – keramzit concrete. The fill-in materials are supplied under pressure, along a pipeline with a Ø150-mm diameter and length of about 1500 m.

Methods of control and monitoring during the institutional control period (tunnel type repository specifics)

The activities during institutional control are in general the same for both types of repositories. With tunnel type repository, direct control on underground waters passing through radioactive waste tunnels is impossible thus it is planned to continue the operation of the experimental shaft during the whole period of institutional control and to perform experiments in it that will help make indirect conclusions on the condition of underground constructions.

IP does not directly affect protected areas pursuant to the Protected Areas Act (PAA) and protected areas (PA) from Natura 2000 Network pursuant to BDA, but is close to PA BG0002009 "Zlatiyata" for wild conservation, BG0000533 "Kozloduy Islands", BG0000614 "Ogosta River" and BG0000508 "Skat River" on the protection of natural habitats and wild flora and fauna. The expected impact on the subject and goals of protected areas are detailed and evaluated in an Impact Degree Assessment Report (IDAP).

The EIA procedure performed is in fulfilment of Decision No. 15645 of 26/11/2013 of the Supreme Administrative Court (SAC), delivered in a sitting by five Judges, to maintain Decision No. 11040 of 22/07/2013 of SAC delivered in a sitting by three Judges.

due to the following motives and factual grounds:

1. The EIA Report describes and analyses the environmental and human health components and factors, their sensitivity and potential impact. The possible impacts on the environment and human health are described (in radiological and non- radiological aspect), with a detailed analysis, prognosis and assessment of the impacts on all environmental components and factors, as well as the health and sanitary aspects during the construction, operation, closure and the following institutional control of the NDF, and justified conclusions have been made on the proposed technologies for the disposal of low and intermediate level RAW, due to the following:

1.1. On the basis of the justification in the EIA report, and due to the fact that no significant industrial polluters are present in the region, it can be concluded that the quality of ambient air is not expected to deteriorate in the region during the NDF's realization. No impacts are forecast as regards the radio-ecological condition as a result of the IP implementation both on the stage of construction, and during the repository's operation period. The packaging of the conditioned RAW (RCC) and the other engineering barriers of the NDF ensure that no radioactive compounds are spread and that the environment is protected from radioactive contamination. No change in the gamma radiation background and the atmospheric radioactivity is expected in the area due to the NDF implementation. The IP implementation for NDF Radiana is not a source of radiation pollution of ambient air either for a tunnel, or for a tranche type of repository.

1.2. The impact of waste non-radioactive waters on the receiver – Danube river during operation will be local, continuous, reversible but negligibly small. The estimated impact on ground water for the period of closure and on the institutional level has a local scope, is direct, negative, with low-degree impact, by type and is by nature continuous, long-term, and reversible after closure. The lack of radioactive sources during construction excludes any radiation impact on ground waters. During the operation of NDF it is not expected for either type of repository that radiation indicators of ground waters may shift beyond the typical background levels for the region. The quality of the waters of the receiver – Danube river, and the other water bodies in the region will remain unaltered. The IP implementation for NDF Radiana is not a source of radiation pollution of ground water neither in a tunnel, nor in a tranche type of repository.

No impact is expected on underground waters, including on water sources for water supply for drinking of the town of Kozloduy, Kozloduy NPP and the locations within the region either during construction, and during normal operation, or after the closure of NDF. No significant negative impacts in radiological aspect are expected (beyond the typical background levels for the region), taking into consideration the envisaged engineering barriers to radionuclide transfer in the environment and the existing unsaturated zone between the disposal facility and the saturated zone (aquiferous horizon).

1.3. During construction the impact on the bowels of the earth will be of low to medium significance, but this is objectively inevitable. It will be mainly manifested in excavation and backfilling works during the construction of NDF and ancillary buildings and facilities. The territorial scope of impact is within the investment proposal site. No cumulative and cross-border

impact is expected. The engineering barriers built ensure the non-proliferation of radioactive substances and the protection of the bowels of the earth in the period of NDF operation and closure.

1.4. Impact on soils is expected during the construction of the site where the facility will be realized, however this area is not used for agricultural purposes. It is expected that the soils will be additionally polluted to a certain extent with dust during construction, but this will be temporary. During the normal exploitation of NDF no additional impact is expected from non-radiational factors on soils. During repository closure impact will be short-term – only during reclaiming of the terrain and its landscaping which will improve the condition of soils, and the green areas will have a positive environmental effect on the whole territory. In emergency situations it is expected that soils will be affected in two aspects – emergency on the territory of the repository, and one caused by another site on the territory of Kozloduy NPP. In both cases impact will be temporary, and its degree will depend on the degree of the emergency. In non-radiational aspect, impact on soils will be manifested in an increase in air-dust emissions on them, additional mechanical pollution, waste, etc. No cumulative and cross-border impact is expected. No change is expected in the radiation indicators of the soils beyond the typical background levels for the regional resulting from the implementation of the NDF.

1.5. There are no grounds to claim that the construction and operation of the site will cause any significant negative effects on the flora and fauna if all the legislative requirements for safe operation and environmental protection are followed.

The species present in the vegetation within the investment proposal's region, are widespread and well-represented throughout the country and are of no significance in terms of conservation. IP's realization is not related to loss of valuable and rare plant species and with damaging typical and valuable plant habitats for the country, because the affected area is an artificially planted forest whose dominant species is the acacia which is an introduced species for our country.

As regards the animal world, negative impacts are expected during the construction of NDF, and they will be direct mostly as regards less mobile invertebrates within the borders of construction sites and a small number of amphibians and reptiles of vertebrate fauna where there are any of those present on site, secondary impacts involving driving lactating fauna and birds away, as well as indirect impacts on individual species from certain taxons spread in the territories immediately adjacent to Radiana site.

1.6. During the construction stage, there will be changes in the landscape structure. The impact is evaluated as long-term, continuous, but insignificant in scope, within the construction site. During construction there will be changes in the visual perception of landscape within the construction site. New anthropogenic elements will appear in the landscape structure. Upon reclaiming individual areas it is expected for the site to fit in the surrounding environment. The IP operation period is not associated with any negative impacts on the components of the landscape.

1.7. Generated non-radioactive waste from IP's realisation during construction, operation and closure under strict control and effective management will not have any significant impact on individual environmental components and factors. No cumulative and cross-border impact is expected.

1.8. During the construction and closure of NDF no radioactive waste is generated on the NDF site. With the technical solutions proposed, and with strict control and effective management of the facility no impact is expected during the period of operation of NDF, either.

No risk for the environment, the working environment and the population in the region is expected.

1.9. If the safe operation and storage instructions, related to the use of chemical substances and mixtures rated as dangerous, are strictly followed, no risk is expected for the health of workers, the population in the region, and the environment.

1.10. Due to the sufficient remoteness of the repository site from localities, the activities involved in its construction, operation and closure, will not be a source of noise for them. The means of transportation used during the construction of the repository, depending on the routing along the road network within the region, will affect the acoustic environment when passing through localities only during the day. The specialized means of transportation used to transport RCC during NDF operation will not go through the territories of nearby localities. No excess noise levels are expected along the borders of the RAW repository site.

The main source of ionising radiation are original packaging – radioactive waste containers. During the period of closure it is planned to construct a multi-layer cover and to decommission the buildings that are not necessary for the follow-up institutional control. During the institutional control a monitoring of the site will be ensured. No other activities are planned with the exception of minimum technical servicing or repair works, if such are necessary. After the completion of this period the disposal activity is limited to allowing the site to be used without any radiological limitations.

No ionizing radiation from disposed containers with RAW is expected above the radiological criterion (0.1 mSv/a) allowed. The power of the dose on the surface of the terrain will be within the fluctuations of the natural gamma ray radiation background for the region.

1.11. During the construction no non-radiational impacts on the population are expected beyond the borders of the construction site. The health risk for construction workers is temporary, short-term, without any cumulative effect, reversible and controllable. During the construction no impact from radiation factors is expected due to the lack of significant, permanent and non-regulated radioactive sources. In non-radiational aspect, the operation of NDF during the whole operational period will not have any negative impact on workers and population within the 2- and 30-kilometre area around Kozloduy NPP;

In radiational aspect, under normal operation and in compliance with all proposed measures, NDF will not affect the health status of the population within the 30-kilometre area around Kozloduy NPP. It is expected that the potential radiational impact on the staff will be within the project requirements. No negative non-radiational and radiational impact is expected from the closure of NDF, if the closure plans and all the existing Bulgarian and international legal requirements and practices are followed.

1.12. With the measures proposed for the protection of immovable cultural values present on the site (should such be identified), and with complying with the *Cultural Heritage Act*, no harmful impact is expected during the periods of construction, operation and closure.

2. IP's realization will not lead to a significant negative impact on the protection subject and goals within the closest protected areas BG0000533 "Kozloduy Islands", BG0000508 "Skat River" and BG0000614 "Ogosta River" for the protection of natural habitats and wild flora and fauna, given the following circumstances:

2.1. IP's realization is not related to any removal of areas from the scope of protected areas or to cutting bio-corridor links between them, therefore their integrity, structure and functions will be preserved, and no significant indirect and direct impacts will be caused to natural habitats, species habitats, subject to protection in them;

2.2. IP's implementation will not lead to fragmentation of natural habitats and species habitats subject to protection in nearby protected areas, because it will be done entirely outside of those areas;

2.3. IP's implementation on the stage of construction will not have a significantly negative impact on the types of fish, amphibians, invertebrate, reptiles and mammals subject to protection in nearby protected areas, given the construction site's remoteness from their habitats.

3. IP's implementation will not lead to a significantly negative impact on the protection subject and goals in the nearby protected area BG0002009 "Zlatiyata" on the protection of wild birds, having in mind the following circumstances:

3.1. IP's implementation will be performed on a terrain located outside of the protected area, and no areas are planned to be taken away from its scope, thus the integrity, structure and functions of BG0002009 "Zlatiyata" protected area on the protection of wild birds will not be damaged;

3.2. Pursuant to the studies conducted by the authors of IDAP, the site intended to be constructed at NDF does not fall within the scope of a birds migration corridor, thus the implementation of IP is not expected to lead to the destruction of key territories significant to the migration of wild birds;

3.3. The results from the field studies conducted show that the area intended for IP's implementation, is located on an acacia plantation of artificial origin. It is neither a main nesting and feeding habitat, nor a resting place for birds, subject to protection in the protected area, therefore there will be no significantly negative impact involving fragmentation or destruction of habitats and damaging population structure and integrity. The field study in the region of the site did not register any nesting of bird species subject to protection in the area.

4. The degree of noise levels during IP's implementation, that might lead to disturbance and driving away of species, including of birds, will be insignificant, given the remoteness from protected areas, and given the species' having adapted to the existing site of Kozloduy NPP.

5. No significant negative impact is expected on the subject of protection within the nearby protected areas as a result of cumulative impact from the realization of the present IP together with past, present and future plans, programmes, projects and investment proposal.

6. An engineering barrier system of several layers is planned to isolate NDF, so as to ensure there are no changes in the radiation background on the site. Any possible radiation pollution is minimised as early as on the stage of "sealing" of waste in reinforced concrete container, with the lower reinforced concrete plate allowing for the collection of any water that has infiltrated the construction and its direction of an infiltrated water control network. Therefore the number and structure of species population (including birds), subject to protection in nearby protected areas will not change as a result of IP's realization

7. Pursuant to the conclusion of the team of experts who developed the EIA Report, no significant non-radiological negative impact on the environmental components and factors is expected upon implementation and observation of the proposed measures.

No radiation impacts are expected on the waters, lands and soils, geological environment, bowels of the earth, land use, mineral diversity, biodiversity, objects of historical and cultural significance, objects protected by an international or national legislation as well as on the health of the personnel and population within the 30-km zone around Kozloduy NPP. The results from the doses assessment during the period after the closure of the repository in the Intermediate safety assessment show that during normal operation the individual effective dose for individuals of the population does not exceed the limit of 0.1 mSv/a, fixed by the nuclear

legislation and the recommendations of the International Commission on Radiological Protection. The individual dose is below 0.01 mSv/a.

During the construction of the NDF are applied the following fundamental principles for RAW management, formulated by the IAEA:

- Protection of human health;
- Protection of the environment;
- Protection outside the national boundaries;
- Protection (non-burdening) of future generations;
- National regulatory base;
- Control on the generated RAW;
- Dependences between the generated RAW and its management;
- Safety of the facility.

The dose loading of the personnel during the operation does not exceed the limits fixed in 2012 on the basic norms of radiation protection, and in the *Regulation for safe management of radioactive waste*, and will be in practice significantly lower compared to the requirements of the ALARA principle (as low as reasonably achievable).

The maintenance of the monitoring ensures detection of specific radionuclides and lack of statistically significant changes in the levels of other pollutants.

Consequences from accidents are examined and analysed, and it is recognized the characteristics of the RAW packages, the type of waste form, the specific activities that should be carried out during the operation. Occurrence of such events is of limited possibility because of prevention and administrative measures, and they have expected radiological consequences where the dose limit for an individual of the population is determined to up to 1 mSv/a.

Considering the radiation characteristics of the packages with radioactive waste which will be disposed at the NDF and the presented assessments for the environmental impact of the Kozloduy NPP, no cumulative effect in the zone for preventive protective measures (ZPPM) of both sites is expected. During NDF's operation period, and in the period after its closure, no direct gaseous and liquid emissions are expected.

On the basis of the conducted analyses and the assessment of impact on all environmental components and factors, including protection of the biological diversity from the realization of the investment proposal a priority selection of disposal technology is a repository of **trench type** as it ensures greater safety.

8. The technology involving the disposal of radioactive waste in tranche type repositories is a modern technology tested in practice and implemented in several countries having advanced nuclear energy. (England, USA, Japan, France, etc.). The use of this technology corresponds to the requirements of the *Law for Safe use of Nuclear Energy* related to the implementation of technologies consistent with internationally recognized operation experience.

9. The construction of NDF closes the cycle of management of low and intermediate level radioactive waste of category 2a in accordance with the national legislation requirements, IAEA's safety standards, as well as the best practices in radioactive waste management in EU. The project's implementation aims at the safe disposal of low and intermediate level waste type 2a and their sustained and permanent isolation from the environment and people.

10. By Decision No. 898/08.12.2011 f the Council of Ministers, the repository to be constructed on Radiana site is designated as a national site and site of national significance.

11. Pursuant to the opinion of Basin Directorate for Water Management (BDWM) in the Danube region, with Ref. No. 5572/03.11.2014, the investment proposal is eligible in terms

of environmental goals for achieving good condition of waters, stipulated in River Basin Management Plans (RBMP) for the Danube Region. The project implementation will not have a significantly negative impact on waters and water ecosystem if the provisions of the *Water Act* are followed and if certain conditions included in the present decision are fulfilled.

12. As regards the analysis and evaluation made in the report of the significance of the positive and negative effects on people and the possible health risk related to the realization of the investment proposal, a letter has been received from the Ministry of Health (MH) (with Reg. No. 04-09-164/02.02.2015 MH) expressing a positive opinion on the documentation. Pursuant to the letter, according to the analysis and evaluation made in the report on alleged impacts, if all conditions and recommendations from EIA report are followed, no health risk is expected to arise for the personnel, population and the environment, including in radiational aspect (incl. cumulative effect from existing and future nuclear facilities on the selected site), during normal operation, in emergencies and after closure of the repository.

13. Pursuant to the opinion received from Executive Environment Agency (EEA) with ref. No. 26-00-9931/14.11.2014 the construction of the repository is of national and strategic significance and will ensure that the main principle in the management of radioactive waste will be guaranteed, namely – individuals, the public and the environment must be protected from radiological risks. If all international and national safety and security standards and rules are followed, the construction and operation of the new facility shall be environmentally-friendly.

14. Consultations with stakeholders were performed during the EIA procedure. The EIA Report with all its annexes are publicly accessible, and public discussion meetings were held on 16 and 17 April, as well as within 27–30 April 2015 in Kozloduy Municipality, and Harletz village on the territory of which Radiana site is located, as well as the municipalities of Miziya, Valchedram, Hayredin, Oryahovo, Borovan, Lom, Krivodol, Boychinovtsi and Byala Slatina jointly with the town halls falling within the 30-km zone around Kozloduy NPP site.

During the public discussions, issues related to the facility's safety including in cases of failures, treatment of waste generated during construction and operation, the presence of compensatory measures in case of damages to the road surface from the passing of heavy-duty vehicles and compensations for the population were examined, taking into account other countries' experience in dealing with repositories, the security of engineering barriers, the possibilities of providing jobs for the local population.

The questions raised during the public discussion meetings were answered and an opinion was expressed by representatives of the team of experts who issued the environmental impact assessment report (EIA) and IDAP and by the employer. During the public discussions, numerous written opinions were received mainly in support of IP, but also ones against the realization of the intention.

The principal has presented a written opinion (with Ref. No. OBOC-1/11.05.2015 MEW) pursuant to Art. 17, para. 5 of the Ordinance on EIA. Before, during and after the meetings for the public discussion of EIA Report with IDAP, as well as within the EA Ordinance on a one-month term of public access to IDAP, no motivated written opinions, proposals or objections were received that would fall in the scope of the hypothesis under Art. 39, para. 10 of EA Ordinance, respectively Art. 17, para. 7 of the EIA Ordinance.

During the public discussions of EIA Report, as well as during the course of the procedure, no motivated lawful objections were deposited concerning the realization of the investment proposal.

15. In implementation of the EIA Convention requirements in a cross-border context and on the grounds of Art. 98, para. 1 EPA, the procedure was executed in a cross-border context.

Given the willingness expressed by Romania (as a party affected by IP realization on Bulgarian territory) to take part in a cross-border EIA procedure (by a letter No. 7439/NN/15.09.2009), during the course of EIA procedure, an updated EIA terms of reference was sent (translated in English). The terms of reference was also published on the webpage of the Ministry of Environment and Water of the Republic of Bulgaria.

With regard to the additional information (on the Bulgarian court's motives in revoking EIA Decision No. 31-9/2011 of the Minister of Environment and Waters concerning investment proposal „National disposal facility for low and intermediate level radioactive waste" and the presence of new elements or changes in the project's characteristics in terms of intention) requested on the part of Romania, the Romanian Ministry of Environment, Water and Forests (MEWF) were sent the sections from the positively quality-assessed EIA report – Non Technical Summary, part "Cross-Border Impact", and the Impact Degree Assessment (IDA) concerning the protected areas from Natura 2000 ecological network, as well as the requested information.

By a letter of March 2015 the Romanian side was informed of the scheduled meetings for public discussion on Bulgarian territory and for the provision of access to the EIA report (with the whole documentation translated into English) through MEW's webpage.

A letter with reg. No. OBOC-1/28.05.2015 was received at the Ministry of Environment and Water (MEW) from the Minister of Environment, Water and Forests of Romania, containing summarized opinions of Romanian competent authorities. In response (by a letter of 30 July 2015) to the Romanian MEWF, an opinion of the employer State Enterprise "Radioactive Waste" (SE RAW) on the questions raised was sent.

Answers were also sent to the Romanian MEWF on questions raised and clarifications regarding requests on the Romanian site (by letters with Reg. No.328/CPP/17.12.2015 and Reg. № 9328/CPP/11.03.2016), and documentation translated into English.

A proposal for a public discussion of EIA report was received by a letter from the Romanian side (with reg. No. 99-00-95/17.05.2016 of MEW). The public discussion meeting was held on 09/06/2016 in Craiova, Romania, attended by Romanian and Bulgarian citizens, institutions and organizations. Translation and presentations in Romanian were provided. The attitudes of the local populations were presented at the meeting which were generally against the construction of the repository for radioactive waste disposal on Radiana site. The Bulgarian side was presented with lists from the public discussions with comments of stakeholders and additionally provided opinions.

In relation to the public discussion held in Craiova, Romania, of the EIA report, an opinion of SE RAW was drafted on the questions raised and the proposals, opinions and objections made, and was sent to MEWF of Romania by a letter with ref. No 99-00-217/16.08.2016

In response, a letter was received from MWEF of Romania (with Ref. No. OBOC-1/04.11.2016), specifying certain conditions to be included in the decision under the procedure (on the grounds of Art. 6 of the Convention on Environmental Impact Assessment in Transboundary Context), and the requirement was imposed to perform analyses after the project implementation (on the grounds of Art. 7 of the Convention).

16. By its Decision I-7/2016 of 15/12/2016, the Supreme Expert Environmental Council proposed the approval of the implementation of the investment proposal

and under the following conditions:

I. For the design stage:

1. The activities involved in realization of the investment proposals must be performed in compliance with the applicable measures ensuring good water status, defined by a RBMP for the Danube region.

2. The provisions under Art. 46, para. 2 of the *Water Act* (WA) and the prohibitory measures on the protection of underground waters from pollution pursuant to Art. 118a, para. 1, its. 2 – 4 WA must be followed.

3. The requirement that the activities of draining, infiltration and removal of natural resources concerning underground water bodies shall be subject to authorisation pursuant to Art. 44 and Art. 46 must be complied with, except in cases under Art. 58, para. 1, it. 6. WA.

4. In designing and follow-up realization of the site, consideration must be given to rain (surface) waters, taking into account the requirements of: At. 46, para. 1 WA, Art. 3, its. 3, 5 and 6, and Art. 6, para. 1, its. 1, 3 and 4 of Ordinance No. 2 of 08/06/2011 on Issuing Permits for Waste Waters Discharge in Water Bodies and Specifying the Individual Emission Limits of Point Sources of Contamination, as well as Art. 1, it. 6 of the same Ordinance.

5. Permit No. 13750001/20.04.2007 and its amendments on the use of a ground water body for the purposes of disposal of waste water from Kozloduy NPP, is subject to amendment so as to include waste waters from NDF pursuant to Chapter Four, Section III of WA and the Ordinance on the use of ground waters (adopted by Decree No. 200 of 13 July 2011).

6. In case any water bodies are affected by the activities planned during the construction of a linear infrastructure crossing water bodies – aqueducts, bridges, transport networks and tubes, pursuant to Art. 46, para. 1, it. 1, letter b) of WA, a permit is necessary to be issued for the use of a water body, except for in the cases under Art. 46, para. 5 of WA.

7. A project for planting and a project for reclaiming to be developed and coordinated with expert ornithologists, biologists, forestry engineers, etc., who will offer recommendations for sustained development of the ecosystem, and respectively, the biodiversity in the region.

8. When planning construction, the calendar schedule for the execution of construction and installation works must be consistent with the time limits and prohibitions related to the execution of construction works. If it is necessary for the construction to begin between 15 March and 13 June, the construction site's terrain must be cleared-off of forest vegetation in advance.

9. In devising the transport scheme under the Plan for organization of the construction, heavy-duty machines' crossing of localities is to be limited, where possible.

10. The concrete structures of the water and sewage infrastructure to be designed and made of damp-proof concrete. The sewage system to be made of materials that allow high level of water impermeability.

11. A special storage facility should be realised in the repository's laboratory for chemical substances and mixtures, which is built in accordance with the normative requirements.

12. Prior to the beginning of the NDF construction it is necessary to develop organisational and management measures for safe storage of the used hazardous chemical substances and mixtures (including paints, fuels and lubricants) in accordance with the requirements of the *Regulation on the terms and procedure for storage of hazardous chemical substances and mixtures*.

13. The waste to be generated during construction and operation of the site is to be classified pursuant to *Regulation №2 on the classification of waste* (promulgated in SG, ed. 66/2014). A Plan for construction waste management is to be devised pursuant to Art. 11, para. 1 of the *Waste Management Act* (WMA).

II. During the construction:

1. No construction works, disposal of domestic and construction waste are to be performed within the nearby protected areas.

2. Separate collection of waste must be planned, as well as their regular transportation and transfer for follow-up treatment to persons having a document under Art. 35 WMA.

3. Prior to the start of construction, the Employer is to prepare its own assessment of possible cases of immediate danger involving ecological damages, and for ecological damages caused, concerning the activities from the scope of application of the *Act on the responsibility to prevent and remove ecological damages*, pursuant to Annex No. 1 of the *Regulation No. 1 of 29/10/2008 on the preventive and remedial measures in the Act on the responsibility for prevention and removal of ecological damages, and on the minimum amount of expenses for their implementation* (promulgated in SG, ed. 96/07.11.2008) and present it at RIEW – Vratsa.

4. Prior to putting into operation of the storage facilities for storage of hazardous chemical substances and mixtures it is necessary that an assessment be made of their safe storage and the results from the assessment should be documented in accordance with the safety information lists and the *Regulation on the terms and procedure for storage of hazardous chemical substances and mixtures.*

III. During operation/closure:

1. The management of waste to be generated, will be implemented pursuant to WMA and the regulations for its implementation.

2. During IP's operational period, the prohibitions under Art. 134, its 1, 3 and 4, and Art. 143, its. 1, 3 and 5, as well as Art. 146 of WA shall be complied with.

IV. Radiological aspect

1. During all the stages of construction, operation and closure of the repository, the ALARA principle must be observed, i.e. the measures to ensure radiological protection must be so ensured as to limit the personnel and population exposure and maintain it at the lowest possible reasonably achievable level.

2. Prior to putting into operation, specific systems for automated "on-line" control of the radiological gamma ray background are to be built. The systems must ensure early detection of possible leaks and provide for the timely execution of corrective measures.

3. The implementation of the Program for pre-operational radiological monitoring to continue: at the Radiana site of the radioecological status of the atmospheric air, ground waters, soils, flora; at the foreseen areas and points of surface flowing waters in the vicinity of the Radiana site.

4. A Program should be elaborated and implemented for disposal radiological monitoring of the site and the SZ of the NDI[2] that monitors the radioecological status of the site and the environment, respectively for each of the zones of the repository having a particular status, as well as a radiological protection program for the repository's operation. After the

programmes are developed, they must be coordinated with EEA, RIEW-Vratsa and the National Centre of Radiobiology and Radiation Protection.

5. A Program for non-radiational monitoring and an Emergency Plan are to be devised and periodically updated, in compliance with the recommendations under it. 9.3 and it. 9.4 of the EIA Report.

6. The Employer shall periodically inform (depending on the frequency of sampling) the Romanian competent authorities concerning the radiological monitoring and immediately in case high levels of radioactivity are detected in any of the environmental components, at all stages of project implementation (construction, operation, closure, period after closure).

7. In order to meet the requirements on the Romanian side, strictly follow the requirements of *Council Directive 2011/70/EURATOM of 19 July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste*.

8. With regard to the requirements of MEWF of Romania, an Emergency Plan is to be devised and complied with, containing measures for events such as heavy rain, earthquake, aircraft fall, terrorist attacks, etc.

9. All necessary measures must be taken and recommendations must be provided to the Romanian side concerning the protection of the Romanian population within the impact zone in the early stages of failure, under the same conditions that they are taken by the repository's operator for the local Bulgarian population in case of failure.

10. Pursuant to Article 7 of the *EIA Convention in a cross-border context*, a post-project analysis (to be presented to Romania) is to be performed, containing the following elements:

- Results from the radiological monitoring of ground and underground waters in the repository's region of impact;
- Inventory of radioactive waste disposed, together with the results from their monitoring.

11. The Employer must comply with the measures provided for in the *National Disaster Protection Plan, the Agreement between the Government of the Republic of Bulgaria and the Government of Romania on operational notifying in case of nuclear failure and exchange of information for nuclear facilities, effective as of 01 January 1998, and the Agreement of 20 January 2016 between the Bulgarian Nuclear Regulatory Agency* (NRA) and *the National Commission for Nuclear Activities Control* (CNCAN) of Romania on the exchange of technical information and cooperation in regulating nuclear safety control and radiological protection pursuant to the requirements of the *Act on the protection of disasters and its regulations,* the *Act on the safe use of nuclear energy;* the *Regulation on emergency planning and emergency preparedness in cases of nuclear and radiation accident,* the *Regulation for the conditions and procedure for establishing of special-statutory areas around nuclear facilities and facilities with sources of ionizing radiation.*

12. Summarized information is to be presented to Romania's MEWF from the report under Art. 37 of the EURATOM Contract corresponding in scope to the Commission Recommendation of 11 October 2010 on the implementation of Art. 37 of EURATOM Contract, considering Romania's requirement for the study of the impact on the Romanian population within the 30-km zone under normal operation of the repository, and for each type of emergency.

V.-Measures under Art. 96, para. 1, it. 6 of the Environmental Protection Act

№	Measures	Period /Stage of Implementation	Result
1.	Prior to the start of construction, the construction sites are to be preventively examined and if any tortoises are found, they are to be moved to neighbouring territories with similar habitats that are at a sufficient distance from the construction sites.	construction:	Protection of animal species from extinction.
2.	Construction and transport equipment in good working order must be used, as well as fuels that meet the standards.	Construction, closure	Limiting the emission of waste gas from engines.
3.	The transport vehicles loaded with earth masses and ballast should not be overloaded. The transport vehicles should be covered when they transport excavated earth masses, construction materials, construction waste, etc.	Construction, closure	Air protection
4.	The open-air storage areas for bulk construction materials (mainly sand) and construction waste to be water-sprayed in dry and windy weather. After the construction works, the areas must be cleaned/reclaimed.	Construction, closure	Air protection
5.	In case of spillage of oils, oil products, etc. immediate measures must be taken to localize the spillage and for follow-up treatment.	Construction, operation, closure	Protection of soils and underground waters.
6.	The removed humus layer must be stored separately and afterwards be used for reclaiming damaged terrains.	construction	Soil protection.
7.	In case structures and findings which appear to be cultural values are found during construction and developing works the activity is immediately stopped and the requirements of the existing legislation are implemented.	construction	Protection of cultural monuments.
8.	Observation of all requirements for health prevention regarding the physiological labour and break regimes and the physiological norms for handling weights.	Construction, operation, closure	Ensuring safe labour conditions for the personnel.

	Strict usage of the provided personal and collective protection means. Observation of all instructions about labour safety and health, and fire safety for the different types of jobs.		
9.	Storage and use of dangerous substances and mixtures is to be performed pursuant to the exposition control measures specified on the safety information lists, and the safe use instructions, incl. measures in cases of spillage or dispersion.	Construction, operation, closure	Protecting the environment from the harmful effects of dangerous chemical substances and mixtures.
10.	Observation of the requirements for loading and unloading for powdery substances and materials that are dangerous chemicals supplied in paper and polymer bags, suitable storage of hazardous compounds.	Construction, operation, closure	Observation of the requirements for working with dangerous chemical substances and mixtures.

The present decision concerns only the investment proposal that has been the subject of the EIA performed pursuant to the Environmental Protection Act. If the investment proposal gets expanded or amended, the Employer must notify the Ministry of Environment and Water (MEW) as early as possible.

On the grounds of Art. 99, para. 8 of the Environmental Protection Act, the EIA decision shall become legally invalid, if within 5 (five) years from its date of issue, no activities have been initiated on the investment proposal.

In case the Employer is changed, the new Employer must, pursuant to Art. 99, para. 7 of the Environmental Protection Act, notify MEW.

If failure to meet the conditions and measures in EIA Decision is established, the responsible persons shall be held liable under Art. 166, it. 2 of the Environmental Protection Act.

Stakeholders may appeal the decision pursuant to the Administrative Procedure Code within 14 days from its notification to the Supreme Administrative Court.

Date: ..... **MINISTER:**

IVELINA VASILEVA